Quarterly
Status, Management, and Cost Report

Contract Name:	Seismic Calibration for IMS Stations in North Africa and Western Asia (Group 2)
Contractor:	Science Applications International Corporation
Contract Number:	DTRA01-00-C-0013
Contracting Officer:	Ms. Shirley Bauer DTRA/AMO, 45045 Aviation Drive, Dulles, VA 20166-7517, 703-810-4637, 703-810-4675(FAX), shirley.bauer@dtra.mil
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Period of Performance:	March 1, 2000 – February 28, 2003
Reporting Period:	September 2, 2000 – November 24, 2000

Background

The Group 2 Consortium is composed of SAIC as the prime contractor with Harvard University, Colorado University Boulder (CUB), University of California San Diego (UCSD), Geophysical Institute of Israel (GII), Multimax, and Western Services as subcontractors. SAIC personnel are resident at the Center for Monitoring Research (CMR).

Travel-time corrections will be developed, tested, and validated in two phases over a period of three years. The team will construct location corrections, as recommended by CTBT/WGB/TL-2/18, using three methodologies: 1) Tectonic regionalization will be used to assign 1D velocity models to each tectonic province and SSSCs computed by 2D and 3D ray-tracing. 2) 3D hybrid models consisting of global and regional models will be constructed and ray-tracing will be performed. 3D hybrid models will make use of the best available models for each region and include tectonic regionalization in areas with poor model coverage. Team members as part of related work may perform revision of 3D models using available data in selected regions. 3) Event clusters will be selected and

Joint Hypocenter Determination (JHD) will be used to define empirical travel time corrections for small selected regions. Inter-comparison of methodologies will contribute to a priori modeling error estimates. Offline unit testing and validation of model-based SSSCs will be performed using existing and expanded Ground Truth (GT).

Progress in Current Reporting Period

(September 2, 2000 – November 24, 2000)

Members of the Group 2 Consortium Keith McLaughlin (CMR), István Bondár (CMR), Hans Israelsson (CMR), Joydeep Bhattacharyya (CMR), Victor Kirichenko (Western Services), Robert Engdahl (Univ. Of Colorado.), Michael Ritzwoller (Univ. Of Colorado), Rami Hofstetter (GII), Winston Chan (Multimax), Indra Gupta (Multimax), Wilmer Rivers (Multimax) and Robert Wagner (Multimax) attended the Ground-Truth Group meeting of the Consortium held in New Orleans on September 13, 2000. A detailed schedule and action items have been posted on the Consortium's web site (http://g2calibration.cmr.gov).

Members of the Group 2 Consortium Keith McLaughlin (CMR), István Bondár (CMR), Hans Israelsson (CMR), Joydeep Bhattacharyya (CMR), Victor Kirichenko (Western Services), Adam Dziewonski (Harvard Univ.), Michael Antolik (Harvard Univ.), Robert Engdahl (Univ. Of Colorado), Michael Ritzwoller (Univ. Of Colorado), Anatoli Levshin (Univ. Of Colorado), Antonio Villasenor (Univ. Of Colorado), Rami Hofstetter (GII), Gabi Laske (UCSD), Winston Chan (Multimax), Wilmer Rivers (Multimax) and Robert Wagner (Multimax) attended the Modeling Group meeting of the Consortium held in New Orleans on September 14, 2000. A detailed schedule and action items have been posted on the Consortium's web site (http://g2calibration.cmr.gov).

Members of the Group2 Consortium Keith McLaughlin (CMR), István Bondár (CMR), Hans Israelsson (CMR), Joydeep Bhattacharyya (CMR), Indra Gupta (Multimax), Wilmer Rivers (Multimax) and Robert Wagner (Multimax) met at SAIC on October 11, 2000 and November 21, 2000 to coordinate ground truth collection activities in Spain and Africa.

The DOE (LLNL) data distribution for the Consortium was delivered on November 6. The distribution is posted on the password-protected site of the Consortium (http://g2calibration.cmr.gov/calibration/protected). The delivery consists of calibration events, regional models of the Middle East, North Africa and Western Eurasia along with a description of the delivery.

A password-protected site (http://g2calibration.cmr.gov/calibration/protected) for the Consortium was created and posted to Consortium members on September 19, 2000.

A major database breakdown occurred on the CMR archived Oracle relational database on November 10. The consortium Oracle database was heavily impacted and we are rebuilding it as the database comes back online.

A Data Delivery Plan (DDP) setting up the protocol for submitting Consortium products to the DTRA Research and Development Testbed (R&DTB) has been published with inputs from R&DTB personnel (http://g2calibration.cmr.gov/calibration/files/Group2_DDP.pdf).

Several abstracts (Harvard, CU Boulder, UCSD) were submitted to the Fall AGU meeting in San Francisco to be held on December 15 - 19, 2000:

Antolik, M., G. Ekström, A. M. Dziewonski, Y. J. Gu, L. Boschi, Improving Earthquake Locations Using Three-Dimensional Models: A new Reference Global P and S Velocity Models, Fall AGU Abstract, 2000.

Cotte, N., and G. Laske, Validating Seismic Models in Eurasia using Surface Waves, Fall AGU Abstract, 2000.

Shapiro, N., M.H. Ritzwoller, A. Villasenor, and A.L. Levshin, Shear Velocity Structure of the Eurasian Crust and Uppermost Mantle, Fall AGU Abstract, 2000.

Villasenor, V., M.P. Barmin, M.H. Ritzwoller, A.L. Levshin, E.R. Engdahl, Parameterized Prediction of Travel Time Correction Surfaces, Fall AGU Abstract, 2000.

Several papers were presented and published (as a conference volume) as part of the Seismic Research Symposium in New Orleans, September, 2000:

Group 2 Consortium, Source Specific Station Corrections (SSSCs) for International Monitoring System (IMS) Seismic Stations in North Africa, Middle East and Western Asia, 22nd CTBT SRS, 2000.

Laske, G. and N. Cotte, Surface wave propagation effects observed at the Saudi Seismic Network, 22nd CTBT SRS, 2000.

Ritzwoller, M.H., M.P. Barmin, A.L. Levshin, A. Villasenor, and E.R. Engdahl, Estimates of Pn and Sn across Central Asia**,** 22nd CTBT SRS, 2000.

Villasenor, A., M.H. Ritzwoller, M.P. Barmin, E.R. Engdahl and A.L. Levshin, Computation of travel times and station correction surfaces in Eurasia using 3D velocity models, 22nd CTBT SRS, 2000.

Reference events (GT0-5) and seismic event bulletins are being collected in the Consortium's region of interest (15S-80N, 40W-100E):

- The Koyna Dam events (India) have been delivered to the Consortium by CU, Boulder.
- Multimax submitted 12 reference events from the IGN, Madrid, Spanish bulletins.

- CUB submitted the EHB events bulletin to the Consortium that is a new groomed version of the ISC/NEIC bulletins for the period 1964 – 1999. The groomed data set consists of nearly a million hypocenters and associated phase arrival times, as well as new phase data obtained from other sources, which have been reprocessed using the EHB algorithms (Engdahl, et al., 1998).
- GII provided potential reference events from Turkey, Greece, Italy and Israel.
- The Consortium members are vetting the reference events delivered by DOE.
- Multimax, SAIC and GII are initiating and pursuing contacts with foreign scientists in the Consortium region of interest.

Model development is under way:

- Harvard created an inventory of surface wave (Rayleigh and Love group and phase velocity) measurements (Ekström et al., 1997) available for the Consortium.
- Finite difference based ray-tracing codes developed by CUB (Villasenor et al., 2000) has been installed at CMR by SAIC. Preliminary SSSCs have been computed at SAIC and a plan for the use of computer resources at CMR by the Consortium has been developed.
- CMR developed a seismic regionalization of the crust in the region of interest.
- CUB constructed a high-resolution regional mantle S-wave model in Eurasia.
- Harvard is developing global P and S velocity models that will be delivered to the Consortium.
- CUB constructed hybrid models by combining global mantle models with global crust and upper mantle models (Shapiro et al., 2000).
- GII and SAIC have jointly carried out analysis of the Gulf of Aqaba, 1995, sequence.
- UCSD has analyzed Love and Rayleigh wave phase and polarization data from the Saudi Arabian network and tested the feasibility of including arrival angles in the validation of regional scale models.
- UCSD has extracted group velocity curves using Love and Rayleigh wave data in the Saudi Arabian Network.
- UCSD is developing a preliminary $2^{o}\times2^{\circ}$ global crustal model under separate funding that will soon be available to this consortium.

References

Ekström, G., J. Tromp and E.W.F. Larson, Measurements and global models of surface wave propagation, JGR, 102, 8137-8157, 1997.

Engdahl, E.R., R. van der Hilst and R. Buland, Global Teleseismic earthquake relocation with improved travel time and procedures for depth determination, BSSA, 88, 722-743, 1998.

Shapiro, N., M.H. Ritzwoller, A. Villasenor, and A.L. Levshin, Shear Velocity Structure of the Eurasian Crust and Uppermost Mantle, Fall AGU Abstract, 2000.

Villasenor, V., M.P. Barmin, M.H. Ritzwoller, A.L. Levshin, E.R. Engdahl, Parameterized Prediction of Travel Time Correction Surfaces, Fall AGU Abstract, 2000.

Plans for Next Reporting Period
(November 25, 2000 – February 16, 2001)

- The third general Group 2 consortium meeting will be held during the AGU meeting in San Francisco on December 16, 2000. Detailed agenda of the meeting and the action items agreed during the meeting will be posted on the consortium web site.
- Several presentations will be made at the December 15-19, 2000 AGU meeting.
- Collection of reference events, event clusters and local and regional velocity models will be continued.
- Regionalization of the area will be refined.
- Preliminary SSSCs will be calculated through both regionalized and hybrid 3D models.
- GII will visit MEDNET to obtain data from recent events for stations in the region of interest.
- A repository of Consortium data on a dedicated (36 Gbyte) disk will be created at the CMR.
- A Phase I Validation Plan will be drafted in January 2001.
- Preliminary 3-Dimensional models will be delivered to the Consortium in January, 2001, by CU Boulder, Harvard Univ., SAIC and UC San Diego.

Cost Report

See attachments.